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# THE FUTURE ROLE OF THE USAF TECHNICAL OFFICER

by

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I'd also like to gratefully acknowledge the guidance and assistance from my Faculty Research Advisor, Maj Courtney Holmberg, and the staff of the Department of Research. The AU Press, AU Library and AF Historical Research Agency were abundant sources for current and historical references. Lastly, I must give my heartfelt thanks to my wife, MaryAnn, and kids, Ryan and Melissa, for courageously soldiering-on back home at Wright-Patterson Air Force Base, Ohio while Dad completes ACSC here at Maxwell Air Force Base, Alabama.

## *Abstract*

This paper examines the role of USAF technical officers (TOs) as envisioned by the post-World War II Scientific Advisory Board (SAB) report, *Toward New Horizons,* co-authored by General Henry 'Hap' Arnold and the renowned aerodynamicist Dr. Theodore von Kármán. The current role of TOs according to existing career path guides and the future role as envisioned in the latest SAB report, *New World Vistas* are also examined. The examination of the TO role addresses advanced technical education and a clear path to senior leadership positions. The current path to senior leadership positions for TOs appears to be solely through acquisition management. These two areas are addressed explicitly in *New World Vistas,* which highlights the importance of these issues and the future role of TOs ensuring USAF technological superiority in the 21st century. A working definition of USAF TOs is formulated which includes the scientific research and development Air Force Specialty Code (AFSC) (61SX) and the developmental engineering AFSC (62EX) as well as the acquisition manager AFSC (63AX). These specialties currently reside within the acquisition and financial management career area.

The author concludes by proposing a number of innovative ideas. Concepts such as the formation of a technical officer corps (TOC) and its vigorous management by the personnel system to ensure there are no recruitment and retention shortfalls are recommended. This vital national security resource—the USAF technological superiority and the men and women of the TOC who are key to America's current and future technical supremacy—guards our nation from any future technological surprises which may threaten America and the free world.

# Part 1

# Introduction

*For twenty years the Air Force was built around pilots, pilots, and more pilots. The next twenty years is going to be built around scientists.*

— General Henry 'Hap' Arnold, December 1944

General Arnold didn't live to see his vision for the future fledgling air force fulfilled, but he did set in motion the process that ensured the Army Air Force (AAF)—and later the United States Air Force (USAF)—maintained its dominant position through technological superiority in the postwar world. This initial process was based on long-range technology forecasting by the Scientific Advisory Group (now the Scientific Advisory Board or SAB), which led directly to the formation of an independent air force. In tandem with his civilian colleague, Dr. Theodore von Kármán, the two "Architects of American Air Supremacy"[1] realized that American technical prowess had been critically important to help the Allied forces win the war. Additionally, as the war in Europe was winding down, Dr. von Kármán headed a project known as Operation LUSTY (**LU**ftwaffe **S**ecret **T**echnolog**Y**) that examined Nazi projects undertaken at a clandestine, top secret scientific institute in a forest in northern Germany. As he noted, "[We] came to an ominous conclusion. Had the Germans better organized their scientific research, they might have prolonged or won the war. While the scientists enjoyed all the funding necessary to pursue whatever inquiries they chose, they lacked close ties to the military establishment, which regarded them as unrealistic intellectuals who should be isolated from military activities."[2] Dr.

von Kármán and General Arnold were both determined to make American "unrealistic intellectuals" a critical part of AAF military activities, both as uniformed technical officers throughout the ranks and as civilian scientists.

The question may now be asked, how well has the USAF implemented the vision of General Arnold and Dr. von Kármán? Certainly the fall of the former Soviet Union and the overwhelming military successes in the Gulf War both indicate that the US, and in particular the USAF, has maintained a distinct technological advantage over her adversaries during the last half century. Unfortunately, the stark reality is that most technical officers (TOs) do not see very many opportunities to rise to senior leadership positions above the rank of lieutenant colonel in today's Air Force. Apparently, not everyone in the USAF shares General Arnold's vision for maintaining technological superiority through having a cadre of highly trained TOs. For instance, a recent report by an Air Force Association panel stated the following:

> In FY 1997, the Air Force made a poorly coordinated attempt to eliminate graduate studies at the Air Force Institute of Technology (AFIT), the training ground each year for some 550 R&D-specialist officers. By doing so the Air Force in effect decided to shortchange its future ability to initiate or properly manage new technologies. More immediately, *it sent a strong message to officers that there is no longer an R&D career track within the Air Force.*[3] (Emphasis added)

As the primary provider of advanced technical education for USAF TOs, AFIT is extremely concerned with the future role of USAF technical officers. To gain a better understanding of the issues involved, the AFIT Vice Commandant and former Director of Research at Air Command and Staff College (ACSC), Col T.S. Kelso, submitted a research proposal to the Air University Research Database for ACSC students to investigate what the role of the USAF technical officer should be in the next century.[4]

This paper provides a launching point towards answering Col Kelso's question. First, the paper provides a working definition of USAF TOs and what the current USAF personnel system

envisions as appropriate TO career progression. Next, it examines the historical role of TOs from what General Arnold and Dr. von Kármán envisioned at the end of WW II through today's US Air (and some would insist on 'and Space') Force. Finally, the paper looks at current trend implications for the future and presents some novel approaches to how the USAF could better manage TOs to maintain the airpower technological edge the US currently enjoys.

In the next portion of this paper today's Air Force technical officer will be defined. The pending TO personnel crisis is examined via the lure of the civilian sector and the obstacles to promotion. On this last point, it will be shown that the path to senior leadership positions for technical officers is explicitly acknowledged in the career path guide as being through the acquisition management track and acquisition corps membership. The guide recommends that the decision to move from a technical or R&D job to an acquisition management job must be made early in a career to ensure all the non-technical education and acquisition experience requirements are fulfilled by the time TOs make field grade rank. However, as will be shown in later sections, this early decision does not appear to be necessary to prepare for promotion to senior leadership positions in the technical/acquisition area. Furthermore, there may not even be room at the top of the acquisition pyramid when technical officers do get there.

## Part 2

# The U.S. Air Force Technical Officer (TO)

*Wanted: Nerds. Tech field is hot, but image-conscious kids say 'NO'*

— *USA Today* Headline, 16 February 1998

From Hollywood movies such as *Revenge of the Nerds* to *Falling Down*, the public's perception of a scientist or engineer, or a technical officer, is that of a non-athletic type who is smarter than usual when it comes to math, science, and physics. This isn't a negative perception in society at large, as "during his spare time, a young technical officer (*Time Magazine's* Person of the Century Albert Einstein) in a Swiss patent office in 1905 produced three papers that changed science forever."[5] Clearly, those with technical prowess are recognized as valuable contributors to society. The Air Force, on the other hand, prefers to see an undergraduate technical background as simply one of the ways to enter the acquisition corps career path. The technical competence that is gained from advanced academic education and experience is not seen as a viable route to promotion to grades above major, much less to senior leadership positions in today's Air Force.

## Definition of a USAF Technical Officer

For the purposes of this paper, the USAF TO is a member of the acquisition cadre within the career field of mission support officer. Specifically, a TO will have a bachelor of science degree in the natural or physical sciences or engineering. Although these undergraduate degrees are

also used for other support career area AFSC requirements such as civil engineering and communication-information systems, the focus of this paper will be on technical officers within the acquisition and financial management career area. The specific utilization field titles and AFSCs for TOs are Scientific and Research, AFSC 61S, and Developmental Engineering, AFSC 62E. Refer to the Appendix for details on the educational requirements for these AFSCs.

Much like the pilot shortage crisis facing the USAF, the recruitment and retention of technical officers is also becoming a significant problem. General Michael E. Ryan, Chief of Staff of the USAF, recently stated the booming US economy and high-paying private sector jobs are luring young TOs away "to lucrative jobs in high-tech industries."[6] This will eventually create a shortage of experienced USAF technical officers as well. The TO-type 'brain drain' throughout the national security arena has been recognized by the federal government, as "President Clinton is pressing Congress to create an ROTC-like program for computer geeks, to cover college costs in exchange for a four-year commitment to join the government 'cyber corps'."[7] TO education is heavily weighted with computer skills.

Unfortunately, increasing the number of entry-level engineers and scientists into the USAF cadre of technical officers won't solve any long-term, or future problems alone, as advanced education and, more importantly, hands-on experience are crucial ingredients for ensuring Air Force technological supremacy in the future. The USAF has recognized the analogous crucial ingredients for successful air campaigns of advanced combat education and hands-on experience in the pilot corps. An abundance of young pilots won't make up for deficits in combat experience. For TOs, the lure of external high-salary opportunity coupled with the perception of an internal glass ceiling for promotion to senior leadership positions which will be discussed later has created a 'pull' and a 'push' resulting in the current and future personnel recruiting and

retention problems. The pending TO personnel crisis is in direct contrast to the post-WWII situation. At that time technical officers were heavily recruited and nurtured from within with assignments to premier scientific and engineering schools for advanced technical education and their opportunity for promotion to senior leadership positions was unlimited.

## Current Path to the Top

As alluded to previously, the route to senior leadership positions for TOs within the mission support officer career field is explicitly stated in the career path guide. The route to an "exceptional career" [8] at the top of the career path pyramid is to move from a 61S scientist or 62E developmental engineer AFSC to the 63A program management AFSC and become a member of the acquisition corps. For example, within the 61S scientific research and development career path, the guide recommends that TOs "find their route to professional development in this (acquisition) area." The guide also implies that the natural course for "...officers who remain in the scientific research and development specialties *beyond the grade of major...*" is to transition to the 63A program management AFSC. [9]

While the 61S track indicates the "majority of officers" are "involved" in acquisition from initial commissioning, the 62E developmental engineer career path allows for a company grade officer (CGO) to work hands-on engineering before getting on the path to senior leadership positions through the acquisition corps route:

> The majority of the field grade opportunities for engineers are in the acquisition arena. Therefore, it is advisable for engineers to get some acquisition experience and APDP (Acquisition Professional Development Program) certification by the time they are junior majors so *these doors will remain open to them.*[10] ... The Air Force has a great need for engineering officers at the company grade level. These officers are needed for their technical expertise to support a variety of missions. *At the field grade level; however, the Air Force needs less technical and more management oriented officers and the opportunities available for the field grade engineer is quite diminished.* These officers are encouraged to apply their

technical background in the area of acquisition management by crossflowing to the 63A career field.[11]

The guidance to technical officers is that education, training and experience in acquisition program management is the way to "keep the doors open" for field grade promotion opportunities and eventually a senior leadership position for an exceptional career. Technical depth in a given discipline is not required nor is a technical degree.

In fact, an undergraduate education in business or management is a viable substitute for a technical education as basis for award and entry into the acquisition program management AFSC that all technically educated TOs must eventually crossflow into for promotion to senior leadership positions. Furthermore, the continuing education and experience mandated are not of a technical nature. Refer to the Appendix for specific details concerning the 63A program management education, training, and experience requirements. Hence, for technical officers who aspire to senior leadership positions in the Air Force, there is no *promotional* incentive to earn an advanced technical education, such as a technical Master of Science or Doctor of Philosophy degree, or to gain extensive scientific and technical experience.

If the USAF intent is to fill senior leadership positions within the acquisition corps with officers that lack technical depth in their education or experience, then the personnel system appears to be constructed adequately to satisfy that requirement. The career path guide clearly encourages aspiring technical officers to move into acquisition management as soon as possible and forego further technical education or experience. On the other hand, it seems reasonable that at a senior level there are technical decisions that must be made by visionary leaders with advanced technical education and extensive technical and R&D experience. If all the USAF were looking for were senior managers, then contracting civilian CEOs would seem to be a viable alternative. The USAF would never consider placing a civilian CEO in charge of a fighter

wing because of the CEO's lack of combat education and experience. The Air Force's 'business' is to be the decisive force to fight and win America's wars. Following that line of reasoning, a senior leader without advanced technical education and extensive scientific and engineering experience directing the R&D and acquisition of current and future high-tech weapon systems for the technologically superior Air Force does not make good 'business' sense.

In the next part of this paper, the current 'message' for USAF TOs to move into acquisition management before acquiring technical depth is discussed in an historical context. This 'message' is diametrically opposed to the recommendations and career path counseling TOs were given at the creation of the USAF as an independent air force and in the technological heydays of the 1950s, 1960s, and 1970s. Scientific and technical seeds sown by TOs in those first few decades kept the USAF on the leading edge of technology and gave birth to the weapon systems which won the Gulf War and assured NATO's victory in Operation Allied Force.

**Notes**

[1] Maj Dik Daso, *Architects of American Air Supremacy: General Hap Arnold and Dr Theodore von Karman* (Maxwell AFB, Ala.: Air University Press, September 1997).

[2] Michael H. Gorn, *Harnessing the Genie: Science and Technology Forecasting for the Air Force 1944-1986,* Air Staff Historical Study (Washington, D.C.: Office of Air Force History, 1988), 24.

[3] Air Force Association Special Report, "Shortchanging the Future: Air Force Research and Development Demands Investment," Air Force Association Science and Technology Committee, January 2000.

[4] http://research.maxwell.af.mil/Topics_Database/display_topic

[5] Walter Isaacson, "Who Mattered and Why," *Time: The Weekly Magazine,* 184, no. 27 (31 December 1999): Pg. 58.

[6] Dave Moniz, "General Hopes To End Pilot Shortage," *Columbia State,* 14 March 2000.

[7] Elizabeth Shogren, "U.S. Tries To Plug Computer Worker Drain," *Los Angeles Times,* Tuesday, 23 November 1999, Pg. 1.

[8] "Officer Career Path Guide," Air Force Personnel Center, October 1999; on-line, Internet, available from http://afas.afpc.randolph.af.mil/ofcr-cpguide/ch5-8.htm, Chapter 5.8.1, Figure 5.8

[8] "Officer Career Path Guide," ch5-9.htm, Chapter 5.9.2.1

[9] "Officer Career Path Guide," ch5-8.htm, Chapter 5.8.3, 1st Paragraph.

[10] "Officer Career Path Guide,"ch5-9.htm, Chapter 5.9.2.1

[11] *Ibid.*

## Part 3

# Role of the Technical Officer —From Conception to Tomorrow

> *Thanks to the technology that was generated, USAF would be able, time after time, to pull the country's chestnuts out of the recurrent political fires. Thus, the amazing victories of USAF in the Persian Gulf War were the result of a technological progression begun by Arnold and Von Kármán.*
>
> — Walter J. Boyne, 1997

The AAF was caught by technological surprise in the early years of WWII by the advanced fighters of the German *Luftwaffe,* such as the Me-109, and the Imperial Japanese Air Force's Zero. As early as 1942, German scientists provided the *Luftwaffe* with a quantum leap forward in aircraft technology in the world's first jet fighter. The renowned Me-262 was unquestionably the technological superior of any fighter aircraft the Allies possessed. Luckily for the Allies, the Commander in Chief of the *Luftwaffe* failed to comprehend these huge technological advantage German scientists had developed. *Reichmarshal* Hermann Goering's "mental framework was that of a squadron-level fighter pilot" and "he remained largely ignorant of supply, logistics, strategy, aircraft capabilities, *technology, and engineering*—in other words, just about everything having to do with airpower."[1] It is vitally important to recognize the weaknesses in the senior leadership of the only enemy air force the US has faced in the past 60 years that presented a serious challenge. The Nazis were the lead major power in a worldwide axis that brought the nations of the free world to the brink of devastating defeat. General Arnold and his civilian colleague, Dr. von Kármán, realized that American technical prowess had been crucially

important to help the Allied forces defeat Nazi Germany and Imperial Japan and win the war. Their first order of business for the post-WWII era was to ensure America and the (Army) Air Force never lost the technological edge and had technical officers with keen insights who maintained constant vigilance for any technological surprises by enemies of the nations of the free world.

## The Scientific Advisory Board and *Toward New Horizons*

As discussed earlier, in September 1944 the Commanding General of the AAF, General Henry 'Hap' Arnold, asked Dr. Theodore von Kármán to assemble a group of scientists to predict long-range scientific and technical goals for the (Army) Air Force. "What I am interested in," Arnold said, "is what will be the shape of the air war, of air power, in five years, or ten, or sixty-five." Arnold asked von Kármán's group to study such things as jet propulsion, atomic energy, and electronics, and report on their findings.[2] Von Kármán produced *Toward New Horizons,* which analyzed the advances in air power technology during WWII, by the Allies as well as the major Axis powers of Nazi Germany and Imperial Japan. This groundbreaking report became the model for long-range USAF science and technology forecasting. Similar groups have been commissioned to provide their recommendations roughly once every decade since von Kármán, culminating in the most recent version, *New World Vistas--Air and Space Power for the 21st Century,* in 1995. This report was prepared by the Scientific Advisory Board (SAB) at the request of then Chief of Staff of the Air Force General Ronald R. Fogleman and Secretary of the Air Force Sheila E. Widnall. Refer to Michael H. Gorn's *Harnessing the Genie: Science and Technology Forecasting for the Air Force 1944-1986* for an Air Staff Historical Study of all the SAB reports prior to *New World Vistas*. Each of these SAB reports addresses, in some fashion, the role of USAF TOs, their promotion to senior leadership positions, and

advanced technical education. Starting with von Kármán's initial report, the Air Force TO role from the birth of the independent Air Force through predictions for tomorrow will be discussed in the following sections.

## Post-World War II—*Science, The Key to Air Supremacy*

Von Kármán wrote the first of the 13 volumes of *Toward New Horizons* and entitled it *Science, the Key to Air Supremacy.* A far-reaching recommendation was a reorganization whereby "science permeated the entire AAF structure" to ensure Air Force technological superiority for the future. "Scientific results," he observed, "cannot be used efficiently by (airmen) soldiers (sic) who have no understanding of them, and scientists cannot produce results useful for warfare without an understanding of the operations."[3] Von Kármán's summary of recommendations, reprinted verbatim, succinctly describes his vision for educating AAF technical officers. He uses the term training while today the term education would be more appropriate.

1. A certain number of young officers should be selected and given special training at scientific institutions in preparation for future scientific Air Staff work.
2. Technical officers recruited throughout the Air Force's ROTC should be given advanced scientific training up to the level required for an MS degree, in a broad variety of sciences, which have applications to Air Force problems.
3. Additional training should be given 20 percent of the officers referred to in the preceding recommendations, to qualify them for a PhD degree.
4. All future Air Staff and technical officers who receive scientific training should be given one-year refresher courses at intervals of five years.
5. Every effort should be made to retain in the Air Force those research and development officers who received scholastic training at government expense during the war.
6. Flying training should be opened immediately to those officers with scientific training who, regardless of combat experience, otherwise qualify.
7. The AAF Engineering School shall be built up in such a way, that fundamentals of sciences involved in AAF problems shall be included in the curriculum. Exceptionally able graduates shall be selected for further scientific training in civilian education institutions.[4]

Von Kármán's report was initially received with great enthusiasm. But with General Arnold's retirement in 1946 and replacement by General Carl Spaatz, the viability of the SAB and the implementation of von Kármán's recommendations were in doubt. When the independent US Air Force arrived in October 1947, the SAB was considered for abolishment. The senior leadership of the fledging Air Force was simply not interested in long-range scientific advice. Major Teddy Walkowicz, one of von Kármán's principal aides and closest friends, pleaded with von Kármán to fight for civilian science in the USAF. He stated, "If the pilots reign supreme in peacetime as they do in wartime the whole cause will be lost and the tragic course of any future war will be decided long before the first shot is fired."[5] Consequently, von Kármán and Brigadier General Donald L. Putt, Deputy Chief of the Air Materiel Command's Engineering Division, asked the University of Illinois' Dean, Louis N. Ridenour, to chair a SAB working group to prepare a report for USAF R&D reorganization and support. The Ridenour Report of September 1949 "...advocated a sweeping reform of Air Force science: a separate command for research and development (R&D) (which became the Air Research and Development Command); a Deputy Chief of Staff for Development on the Air Staff; and unitary budgeting for USAF development outlays."[6] Over the objections of most top USAF leaders, Chief of Staff General Hoyt S. Vandenberg agreed to and announced implementation of the Ridenour Report's recommendations.[7] As a result, according to Gorn:

> Brigadier General Putt and his cadre of scientifically trained young officers... were elated because they represented the new Air Force, in whose ranks the technical man in uniform would one day lead USAF science. Indeed, Putt likened the R&D officer to his operational counterpart. Just as the SAC or USAFE man dedicated his life to winning air battles, "the technical man devotes his career to the task of putting in the hands of the operational man the best weapons which American science and technology can produce." Putt hoped—perhaps with undue optimism—that the establishment of an Air Force R&D organization would lead eventually to a close and equal partnership among scientist, strategists, and pilots.[8]

The new USAF established a major program that allowed officers to volunteer for advanced technical education at major universities across the United States. Hundreds of volunteers stepped forward for the opportunity to attend top engineering schools. General Samuel C. Phillips (Commander, Air Force Systems Command (AFSC), 1973-75) earned a Master of Science (MS) degree in electrical engineering in 1947 at the University of Michigan. General Robert T. Marsh (Commander, AFSC, 1981-84) earned an MS degree in instrumentation and aeronautical engineering in 1955 at the University of Michigan. Many other TOs rose to senior leadership positions. Lieutenant General James H. Doolittle earned a PhD in aeronautics at the Massachusetts Institute of Technology. General Lew Allen, Jr, USAF Chief Of Staff from 1978-82 had a PhD in physics. The importance of advanced technical education for the officer corps was recognized and there was a personnel system to ensure that importance was recognized through assignment and promotion considerations. As Dr. Ivan Getting, the renowned physicist and member of the SAB stated during his interviews by the Center for Air Force History in 1993:

> There was a great insistence on the need for education of technical officers and the establishment of a promotion system within the Air Force so those technical officers could rise to the highest ranks. If Lew Allen were here, we would have a demonstration that we did have a technical, nonoperating (sic) field officer who became Chief of Staff. That was completely unheard of before.[9]

After WWII, the Air Force realized it couldn't afford to be caught by technological surprise in a future conflict or fail to recognize promising strategic-level technical opportunities. After WWII the AAF recognized the need for advanced technical education for the officer corps and senior leadership to ensure the Air Force retained technological superiority. In the years after the birth of the Air Force, the TOs promoted to senior leadership positions influenced current and long-range R&D and guided the development of ICBMs, stealth, precision weapons, and space assets. Unfortunately, the five main science and technology forecasts by the SAB since *Toward New Horizons* have experienced declining influence in the USAF long-range planning process.

A detailed analysis of these reports isn't possible here and the reader is referred to Gorn's excellent analysis for details. The future role of USAF TOs is addressed in the latest SAB forecast entitled *New World Vistas*. Once again the need for advanced technical education of officers and technical officer promotion to senior leadership positions is recommended.

## Post-Cold War to the 21st Century—Brave *New World Vistas*

As with each previous forecast, the most recent request for the SAB to conduct a scientific and technical forecast for the USAF paid homage to the "Architects of American Air Supremacy." Von Kármán's *Toward New Horizons* was "rooted in the basic sciences" and "stressed the abstract principles of nature and how they related to airpower advancements." Over the years, the "subsequent studies have become more technological than scientific."[10] Hence, *New World Vistas (NWV): Air and Space Power for the 21st Century* is grouped in technology categories which are virtually identical to the Air Force's technology thrusts and core competencies. Table 1 compares the *NWV* primary capabilities with USAF core competencies and technology thrusts.[11]

**Table 1. USAF Current and Future Core Capabilities**

| ***New World Vistas*** | **AFDD-1** | **Technology Thrusts** |
|---|---|---|
| Space Operations | Air and Space Superiority | Space Superiority |
| Global Awareness | Information Superiority | Information Dominance |
| Global Mobility in War and Peace | Rapid Global Mobility | |
| Projection of Lethal & Sublethal Power | Global Attack | |
| | Agile Combat Support | Agile Combat Support |
| Projection of Lethal & Sublethal Power | Precision Engagement | Precision Strike |
| Dynamic Planning & Execution Control | | |
| People | | Training for Warfighting |
| | | Aircraft Sustainment |

**Source:** *New World Vistas,* Summary Volume (Washington, D.C.: USAF Scientific Advisory Board, 1995), 17. ; Air Force Doctrine Document 1; Air Force Association Special Report, "Shortchanging the Future: Air Force Research and Development Demands Investment," Air Force Association Science and Technology Committee, January 2000, 10.

The congruency, or commonality, between the *NWV* technology categories and the USAF core competencies and technology thrusts are distinctly noticeable and "as viewed by the *technologist*, are entirely consistent with the capabilities of Global Reach-Global Power and the Air Force core [sic] capabilities."[12] It is interesting to note that R&D money in USAF technology thrust areas is being targeted to cover costs of training for warfighting and aircraft sustainment. These titles suggest readiness and operations monies rather than basic research, exploratory development, or technology demonstration (6.1, 6.2 and 6.3) R&D funding program elements. Senator Joseph I. Lieberman, a member of the Armed Services Committee, addressed this funding trend of focusing more on the "urgent needs of today: readiness, modernization..." which means the Air Force and the Armed Forces have "been unable to nurture sources of technological strength."[13] He goes on to say "the current structure is not attracting and retaining the best scientific talent. The rigid DOD personnel system and the corresponding lack of performance-based compensation is causing the labs to hemorrhage talent to a more competitive and less bureaucratic private sector." The *NWV* SAB report also recognizes this issue and provides specific recommendations for recruiting and retaining technical officers similar to those given in just about all the other SAB reports since *Toward New Horizons.*

The *NWV* technology category on *People* states "increased tempo of operations and reduced force size will demand that people interact with weapons systems more efficiently than ever before. Science and technology can assist the process of human interaction with the machine of the future."[14] Specific proposals under *Education* address the issue of moving technical officers into the acquisition corps because the USAF is planning to get out of the in-house R&D business. *NWV* states that civilian and industry R&D will provide the USAF "off-the-shelf" technology for weapons systems. However, as General Robert T. Marsh (Commander, AFSC,

1981-84) recently stated, "our store of technology on-the-shelf is becoming sparse."[15] Hence, a new class of future USAF "smart buyers" will need to be "educated in a technical field and have some experience in that field."[16] To wit:

> *We suggest that the Air Force increase the number of technical degrees at the Masters level substantially through funding of degrees at both AFIT and at Universities.* PhD degrees should be increased as well, but a careful study should be done to determine appropriate staffing levels. Quality of degree should be a factor rather than simply its existence. Rating system for Universities and Colleges exist. AFIT should participate to the extent that its curriculum overlaps that of civilian schools. *Degree quality should be a factor in civilian and military promotion.*[17] (Emphasis in original)

The "smart-buyers" are the acquisition corps. The increased advanced technical education proposed for Air Force officers looks remarkably similar to Dr. von Kármán's recommendations 50 years earlier. Those early recommendations were made to ensure a cadre of technical officers were made an innate part of the Air Force personnel system so technical decisions could be made by properly educated senior officers. The Air Force Association makes a similar recommendation; stating the "need to educate and nurture a skilled cadre of Air Force officers in the R&D and S&T (science and technology) community" is of "critical importance."[18] Granted, management decisions are part of senior officers' responsibilities, but those decisions must be made from a 'physical science' perspective as well as 'fiscal prudence.' Truly visionary long-range technological progress and future aerospace superiority should not be forsaken for short-term budget balancing to purchase current generation or legacy weapon systems and platforms.

Under the 'What to Do' portion for *Scientific and Technical Personnel Management,* the SAB states "we must have a path for more scientific and technical officers to attain the highest positions in our Air Force. We, therefore, recommend that the Air Force officers who command laboratories (now directorates since there is only one Air Force Research Laboratory) be given the status and be treated in the promotion system like other operational commanders."[19] This

change in status will require significant changes to the acquisition 'career progression pyramid' mentioned earlier. The career path guide funnels all field rank TOs into the program manager AFSC. The top position of the acquisition and financial management career is designated program director (AFSC 60C0). This is the only command position not designated as a commander. Therefore, this title should be acquisition and financial management commander—like operations commander or logistics commander for the top job in those career areas.

Finally, the 'Organizational Considerations and Recommendations' chapter, the Personnel Practices and Opportunities section contains the following passage:

> Technically educated people will be extremely important to the Air Force of the 21st century. Technology will touch all facets of Air Force life and operations. Although the Air Force can recruit intelligent and productive people by offering funding for advanced and undergraduate degrees, retention of those people will be possible only if career opportunities exist in the long term. For technically educated military personnel, it should be possible to establish a path through the Lab Commander position to Flag rank. The designation of Lab Commander as equivalent to Wing Commander will place the Lab Commander in a promotable position. If Lab Commanders have impeccable technical credentials, the young officer will feel that a technically oriented career has significant advancement possibilities. Fewer will abandon the Force for industrial jobs. We do not suggest that a technically oriented career be pursued only in Laboratories or SPOs (System Program Offices). There should be diversification during a career. We suggest only that the majority of a career be devoted to technical matters. *The Air Force should consider career management of technically oriented officers with the same vigor as that of the rated force.* (Emphasis in original)[20]

(Note: The Air Force lab structure has been modified since 1995 and all labs consolidated into the Air Force Research Laboratory. Hence there is only one 'Lab Commander.' The equivalent to the lab commanders mentioned above would now be the colonel positions designated as directorate chiefs.)

The *New World Vistas* forecast and recommendations bode well for the USAF technical officer. It appears to reflect a desire to go back to the post-WWII environment that saw the rise of scientific and technically trained officers to senior leadership positions. General Lew Allen

(USAF Chief of Staff, 1978-82) made similar comments in a *Tributes and Perspectives* essay in the *Aviation Week & Space Technology* 50th USAF Anniversary issue:

> The Air Force should increase and encourage the technical education of officers at quality universities. These officers should serve not only in the R&D field, but also in logistics, maintenance and operations. It does not require a master's degree in electrical engineering to fly an F-15, but it doesn't hurt either. Science remains the key to air supremacy and qualified people are the key to its application.[21]

These thoughts as well as those of *Toward New Horizons* are similar to the recommendations made for the future role of USAF TOs in this paper. Before discussing those proposals, the next section will present a look at the current role of technical officers in the Air Force by comparing a 'notional' career according to USAF guidance with actual "exceptional careers" of senior leaders at the top of the acquisition pyramid.

**Notes**

[1] Williamson Murray, *Strategy for Defeat, The Luftwaffe 1933-1945* (Maxwell AFB, Alabama: Air University Press, 1983), 5.

[2] Michael H. Gorn, *Harnessing the Genie: Science and Technology Forecasting for the Air Force 1944-1986,* Air Staff Historical Study (Washington, D.C.: Office of Air Force History, 1988), 13.

[3] *Ibid,* 39.

[4] Michael H. Gorn, ed., *Prophecy Fulfilled: Toward New Horizons and Its Legacy,* Air Force History and Museums Programs (Washington, D.C.: Office of Air Force History, 1994), 186.

[5] Michael H. Gorn, *Harnessing the Genie: Science and Technology Forecasting for the Air Force 1944-1986,* Air Staff Historical Study (Washington, D.C.: Office of Air Force History, 1988), 47.

[6] *Ibid,* 49.

[7] Headquarters USAF Staff Study, "Implementation of Ridenour and Air University Reports on Research and Development," 2 December 1949.

[8] Gorn, *Harnessing the Genie*, 50.

[9] Jacob Neufeld, *Research and Development in the United States Air Force,* (Washington, D.C.: Center for Air Force History, 1993).

[10] Gorn, *Harnessing the Genie*, vi.

[11] Air Force Association Special Report, "Shortchanging the Future: Air Force Research and Development Demands Investment," Air Force Association Science and Technology Committee, January 2000, 10.

## Notes

[12] Gene H. McCall, Dr., *New World Vistas: Air and Space Power for the 21st Century,* Summary Volume (Washington, D.C.: USAF Scientific Advisory Board, 1995), 17.

[13] Joseph I. Lieberman, "Techno-Warfare: Innovation and Military R&D," *Joint Force Quarterly,* No. 22, Summer 1999, 14.

[14] McCall, 48.

[15] Air Force Association Special Report, 17.

[16] McCall, 50.

[17] *Ibid.*

[18] Air Force Association Special Report, 12.

[19] McCall, 62.

[20] *Ibid.* 68-69.

[21] General Lew Allen (USAF, Ret.), "Science Remains Key to Air Supremacy," *Aviation Week & Space Technology,* Vol. 146, No. 16, 16 April 1997, 60.

## Part 4

# Today's Role of the Technical Officer in the USAF

*He got passed over to lieutenant colonel because he has 'technical stink.'*

— ACSC water cooler' discussion, 1999

There is a perception among the cadre of technical officers that any track for a TO other than acquisition leads to a career dead-end. In other words, the highest attainable rank is major or lieutenant colonel. As mentioned earlier, the path to senior leadership positions for TOs in today's Air Force appears to be fairly narrow, at best. Even if all the recommendations in the career path guide are followed there may not be room at the top for TOs. This will be shown at the end of this section. The following discussion is a synopsis of the notional career path for TOs as recommended by today's USAF personnel system.

Technically minded officers in the scientific and engineering disciplines are currently under the umbrella of the acquisition and financial management career area. Within that area, the top positions are entitled program director instead of 'career area' commander as in other career fields such as operations commander. The personnel practices recommended in *New World Vistas* address that labeling issue due to its impact on promotion boards. From an analysis of the career path guide, TOs must move into the acquisition manager AFSC to proceed up the pyramid and reach the 'Exceptional Career' level of colonel and above in senior leadership positions. The career path guide gives explicit advice for obtaining acquisition-related depth, breadth, and career broadening early in a career to prepare TOs for the acquisition manager path to the top.

## (Technical) Officer Career Path Guide

In October 1999, the Air Force Personnel Center (AFPC) acquisition officer assignment team put together a "Spread-the-Word" briefing and traveled to various Air Force bases. The presentation slides can be viewed or downloaded from the AFPC website.[1] The slide depicting career field opportunities contained the following:

- AFIT Post-Graduate Degrees
- Education With Industry (EWI)
- Test Pilot School (TPS)
- Career Broadening Programs
- Special Duty Assignments
- Critical Acquisition Positions

These opportunities can be generically grouped into three broad career tracks—academic, acquisition, and operational/test. According to the career path guide, initial assignments for TOs are in the areas of acquisition, R&D, academics, test, or operations. In these positions, TOs are to focus on building primary job proficiency. Operational assignments are available for a first tour and could include career broadening in Operational Space and Missile Tours (OSMT) or an Operational Experience (OPEX) tour. To stay competitive on the acquisition manager path, TOs must also take the Acquisition Fundamentals course or equivalent and complete grade-appropriate PME such as Squadron Officer School. The guide states that during TOs' initial assignment there is strongly recommended acquisition training as well as professional military education to be accomplished in addition to obtaining primary job proficiency.

The career path guide says a second assignment to continue building technical depth could be at AFIT or through an AFIT-sponsored program to obtain an MS degree (if one had not been obtained part-time already). A select few officers can continue their advanced education at AFIT for a PhD, but the majority will proceed after graduation to follow-on assignments with advanced academic degree (AAD) requirements. In fact, validated AAD positions in USAF

units establish quotas for advanced education that drives the personnel system to assign officers to engineering schools for advanced technical education at either AFIT or a civilian university. In effect, the current system prepares technical officers for their next job rather than a career.

TOs who obtain PhDs will more than likely move between SPO or lab assignments or instructor duty at AFIT or USAFA. In SPO or lab positions the career ladder leads to division head or chief engineer jobs. The instructor positions at AFIT or USAFA lead to deputy department and a few department head jobs, but these last positions come open once every decade, at best. Each of these career tracks is essentially academically oriented, but the majority of technical officers on the academic track rise no higher than lieutenant colonel unless they move outside these academic environments or get on the academic track after obtaining significant operational experience.

Education with Industry (EWI) assignments allow technical officers to experience acquisition management or engineering from a contractor's perspective, and Education with Labs (EWL) assignments place TOs in Department of Energy laboratories for 10-months with follow-on assignments to the Air Force Research Lab (AFRL). A second (or third) tour could also include an Acquisition & Logistics Experience Exchange Tour (ALEET). These assignments are essentially career broadening tours and fall under the acquisition and operational/test career tracks. Test Pilot School (TPS) assignments for TOs interested in the test career track are highly competitive, and they may ultimately lead to key leadership positions such as test director or commander. Special duty assignments are primarily for field grade officers (FGOs) and include instructor slots at ACSC, AWC, ROTC, or USAFA (only requires an MS) as well as positions in NAF, HAF or SAF on Ops Staff, Plans & Programs, or International Politico-Military Affairs, to name a few.

Lastly, the career path guide recommends that field grade TOs should be on the acquisition path to a Critical Acquisition Position (CAP) for the surest route to senior leadership positions in today's Air Force. To be eligible for membership in the Acquisition Corps, officers must have Acquisition Professional Development Program (APDP) Level 2 certification, 24 semester hours in undergraduate or graduate business, and four years acquisition experience. The continuum of education for TOs contains PME, technical, and acquisition/business schooling.

From the preceding discussion of a recommended technical officer career, taken directly from the career path guide, it is apparent and strongly recommended that TOs must decide and act early in their career to obtain the acquisition-related education and experience qualifications for the acquisition program manager track. The implication is that spending a tour pursuing advanced technical education or remaining in hands-on engineering assignments instead of accumulating acquisition-related education or experience could lead to roadblocks while moving up the pyramid to senior leadership positions. The pinnacle of the career path pyramid for a technical officer is identified in the career path guide as program director at a major weapon System Program Office (SPO). Hence, the sure route to senior leadership positions and an exceptional career for TOs is to be one of the "select few chosen as program directors."[2]

The stark reality is that a technical officer could spend years preparing for these senior leadership positions on the acquisition program manager path and find at the end there is no room at the top. A different cadre of "select few" are already filling those program director jobs having entered the Acquisition Corps at the field grade rank. These are rated officers with technical education who have acquired acquisition-related education and experience later in their Air Force careers. The following example illustrates this phenomenon.

According to Lieutenant General Michael C. Short, NATO's Joint Force Air Component Commander (JFACC) for Operation ALLIED FORCE, the "more high-tech" Air Force weapons systems used in the air campaign were the F-16 and the B-2.[3] Air Force future "high-tech" weapon systems are the F-22 and the Joint Strike Fighter (JSF). Table 2 shows the grade these "high-tech" weapon system SPO directors were when they entered the acquisition career path and the grade they currently hold. Each one of these SPO directors is a rated officer with undergraduate and advanced technical education, but with little, if any, hands-on engineering, scientific, or technical experience.

**Table 2. USAF "High-Tech" Weapon System SPO Directors**

| SPO | Grade Entered Acquisition Corps | Grade Now |
|---|---|---|
| F-16 | Major | Brigadier General |
| B-2 | Major | Brigadier General |
| F-22 | Lieutenant Colonel | Major General |
| Joint Strike Fighter | Major | Colonel |

**Source:** http://www.asc.wpafb.af.mil/asc/asc/html

The crucial point here is these senior leaders were able to spend time developing their flying proficiency early in their careers and then successfully move onto the acquisition career path at the field grade level. There was enough time to acquire the acquisition-related education and experience before becoming one of the select few chosen as program directors. These rated officers were able to spend their early careers obtaining technical proficiency in their unique specialty area unfettered by additional requirements of acquisition-related education and experience before moving onto the acquisition career track and reaching the top of that pyramid.

The explicit guidance for technical officers in the career guide to neglect building technical proficiency to acquire acquisition-related education and experience to "keep the doors open" to promotion to the top does not appear to correlate well with the facts. Furthermore, with the "strong message to officers that there is no longer an R&D career track within the Air Force

(delivered by) the poorly coordinated effort to eliminate graduate studies at AFIT,"[4] one can see how TOs have an unclear picture of their future role in the Air Force. The picture was not always so murky, as has been shown through the historical analysis in previous sections. The next section presents a few proposals concerning the future role for USAF TOs.

**Notes**

[1] "Acquisition Officer Spread the Word Briefing," Air Force Personnel Center, January 2000; on-line, Internet, available from http://afas.afpc.randolph.af.mil/Acquis/sldovl.htm

[2] "Officer Career Path Guide," Air Force Personnel Center, October 1999; on-line, Internet, available from http://afas.afpc.randoplh.af.mil/ofcr-cpguide/ch5-9.htm

[3] John A. Tirpak, "Short's View of the Air Campaign," *Air Force Magazine,* September 1999.

[4] Air Force Association Special Report, "Shortchanging the Future: Air Force Research and Development Demands Investment," Air Force Association Science and Technology Committee, January 2000.

## Part 5

# Future Role of the Technical Officer in the USAF

> *The Air Force could be said to worship at the altar of technology. The airplane was the instrument that gave birth to independent air forces; and the airplane has, from its inception, been an expression of the miracles of technology... There is a circle of faith here: If the Air Force fosters technology, then that inexhaustible fountain of technology will ensure an open-ended future for flight (in airplanes and spacecraft); and that, in turn, will ensure the future of the Air Force.*
>
> — Carl H. Builder

The *National Military Strategy of the United States of America* and *Joint Vision 2010* call for "full spectrum dominance" in future military operations which "rests on the foundations of information superiority and technological innovation."[1] Both of these foundations require advanced technology; hence, superior technology is an American national security 'seed' competency. The USAF cannot simply rely on off-the-shelf technology or the US economy to produce scientific and technical breakthroughs for quantum leaps in advanced weapon systems. As mentioned earlier, General Robert T. Marsh (Commander, AFSC, 1981-84) recently stated "our store of technology on-the-shelf is becoming sparse."[2] Nor should the USAF rely solely on undergraduate technical education and minimum engineering and science experience for officers. History has shown time and again that technological surprises force the USAF to react quickly and institute crash programs to catch up. For example, at the beginning of the Korean War "there were grievous deficiencies in aircraft armament which plagued its (the Air Force's) early operations there. Consequently, the Air Force had to broaden its armament competency through

such means as offering direct commissions to outstanding persons in this field, expanding the Air Force Institute of Technology's armament curriculum, and affording officers greater opportunity for graduate training in civilian institutions."[3]

In addition to the technical personnel problems of the federal government recognized by President Clinton mentioned earlier, Secretary of the Air Force F. Whitten Peters has painted a portrait of a service beset with troubles that "keep him up at night."[4] In a speech at a Capitol Hill breakfast in February 2000, he said:

> The Air Force has a "time bomb waiting to go off" as thousands of civilian workers with technical and scientific skills approach retirement age. During the past nine years the service has seen a 62% drop in employees with less than eight years' service. Meanwhile, 30% of scientists are within five years of retirement.

This pending crisis with scientific and technical civilians means USAF TOs will 'do more with less' technically experienced co-workers. As shown in the previous section, it should not be necessary for technical officers to neglect technical depth and experience early in a career to acquire acquisition-related education and experience. Rated officers with technical education have been successfully rising to senior leadership positions in the acquisition field by waiting until major or lieutenant colonel to acquire acquisition-related education and experience. Technical officers should be allowed to do the same by spending their early career developing technical depth and experience as well as acquiring advanced technical education to include a PhD. This could be facilitated by implementing *NWV* recommendations and providing advanced technical education along with assignments requiring hard science and technical leadership as opposed to the softer acquisition-related sciences of budgeting and management. The ensuing cadre of technical officers in senior leadership positions would have the right scientific and engineering education and technological foresight to recognize and orchestrate the development

of breakthrough technologies critical to provide advanced weapon systems with quantum leap performance for continuing Air Force superiority.

Furthermore, the future of America's technological leadership may not be too bright. According to an article in the August 4, 1999 edition of *USA Today*:

> Since 1986, the overall number of U.S. bachelor's degrees increased by more than 18%—but the number of students earning undergraduate degrees in engineering decreased nearly 20%. Forty states have shown declines in the number of undergraduate engineering degrees awarded, including such centers of technological innovation as Massachusetts (down 36.2%), New York (minus 30.2%) and California (minus 11.7%).

The dwindling pool of technically educated undergraduates, "a prospering economy, plentiful opportunities for young people with high-tech skills, and ambiguity over the mission of the armed services today are all blamed for recruiting woes."[5] The retention of technical officers is also becoming a problem. To staunch this 'brain drain,' the USAF should act now in the interest of America's national security and our nation's economic prosperity with a concerted effort to form a technical officer corps and career path which includes advanced technical education and ample opportunity for promotion. Furthermore, the USAF should recognize that technological superiority and technical officers constitute the 'seed' competency upon which Air Force core competencies depend.

## Technical Officer Corps (TOC)

The term technical officer corps (TOC) was alluded to earlier in this paper, and at this point it seems reasonable to propose the formulation of such a corps separate and distinct from the acquisition corps. The main reason to do so is to encourage TOs to obtain technical depth before moving into acquisition management. In the rated force, pilots know they can't expect to fly their whole careers if they want to get promoted above lieutenant colonel. The examples in the

previous section showed how rated officers have successfully moved onto the acquisition career path as majors and lieutenant colonels and been selected for senior leadership positions. TOs should also fully understand the need to move out from behind hands-on R&D to acquisition management to move into senior leadership positions. If some of tomorrow's senior leaders have a well-rounded upbringing in the TOC, that includes advanced engineering or scientific education and extensive R&D work, it will ensure they have the background to make technically sound decisions with a firm basis in first-hand experience. The *New World Vistas* proposals to increase funding for advanced technical education through AFIT, to develop a clear TO career progression path, and to vigorously manage how the USAF employs its TOs would be a good start. The next few sections outline one possible way to implement this new TOC.

**A Continuum for Advanced Technical and Professional Military Education**

Just as the fledgling Air Force recognized the need to fill its ranks with technically educated officers after WW II to forego any future technological surprises, today's USAF leaders must also prepare now to maintain the service's technological advantage and senior leadership awareness and vigilance in the 21st Century. The Chairman of the Joint Chiefs of Staff Review Panel Report in 1995 recommended that "war college graduates must possess sufficient technical ability and insight to anticipate and use ever increasing technological advances."[6] The Navy has instituted a creative idea to merge the continuum of PME with a continuum of technical education using a parallel approach. The Naval Postgraduate School (NPS) offers a combined Joint Professional Military Education (JPME) and technical education graduate program.[7] In partnership with the Naval War College, an NPS assignment gives naval officers the opportunity to complete JPME while earning their masters degree.

A viable USAF implementation would be that TOs, or any technically eligible officers, be assigned to AFIT early in their career for a two-year education tour which includes PME and enrollment in a masters degree program in an engineering or scientific discipline. The level of PME would be dependent on rank, such as the Aerospace Basic Course or Squadron Officer School for CGOs. For field grade officers in technical PhD programs, tours slightly greater than three years could be used to also provide the USAF JPME, Phase 1 credit which is currently earned through Air Command and Staff College (ACSC). While enrolled in the AFIT program, students typically conduct thesis research on topics of critical importance to the Air Force Research Lab and the operational Air Force to satisfy degree requirements. This valuable technical expertise can be tapped by the Air Force, and the thesis work experience will give TOs a solid technical foundation. "Past and ongoing RAND research indicates that experience—that is, the steady buildup and maintenance of expertise over time through constant "learning by doing"—is critical in the cost-effective design and development of successful military aircraft."[8]

Furthermore, the advanced technical education and enhanced promotion opportunities of the TOC would be a valuable tool for recruiting recently graduated college students with technical bachelor of science degrees. Currently, most students enrolled in civilian graduate schools are on research or teaching assistantships. Many are very interested in R&D, especially in the "high-tech" USAF. According to members of the National Research Council's Strategic Assessment of U.S. Aeronautics Committee, "the cutting edge of aeronautics R&T (Research & Testing) is most attractive to young, talented engineers and scientists."[9] In addition, this plan would assure retaining and empowering bright TOs that desire to seek doctoral level education. Many field grade officers are currently reluctant to pursue PhDs because of the block of time they spend in

an education environment. Merging PME and advanced technical education into a competitive assignment with enhanced promotion opportunity would change that perception.

**Incentives and a Clear Path to the Top**

Once the USAF attracts and educates this talented cadre of engineers and scientists, there must be an effort to keep them in the Air Force. As mentioned in *New World Vistas*, vigorous efforts similar to those used by the personnel system to retain rated officers must be incorporated. It is reasonable to offer technical specialty bonuses and perks such as black flight suits and black leather jackets. Bonuses could be structured like those in medical career fields or based on being a 'command TO' with a terminal degree or thousands of hours 'supercomputer' or 'lab' time. The unique flight suits and jackets would inspire *esprit de corps* and TOC *élan* associated with being an MiB (Member in Black—a take-off on the sci-fi movie *Men in Black*), much as they have done for the space operations career field. While these ideas may help, "what these people really want are challenges and opportunities to make an impact."[10] Of course, the greatest impacts are made in senior leadership positions.

As the acquisition career guide reads currently, the path to senior leadership positions for TOs is via an acquisition manager track. This path does not particularly value a rigorous undergraduate education in science or engineering, much less a technical master's or doctoral degree. Officers with a technical background are directed to earn acquisition- and business-related academic credentials from initial assignment onward. In reality, technical officers should be allowed to acquire acquisition-related education and experience as majors or lieutenant colonels, just as the rated officers currently holding the "high-tech" weapon system SPO director jobs have done. A vigorously managed TOC would better prepare TOs to become some of the select few chosen for senior leadership positions. It is difficult to understand how USAF senior

leadership can make crucial decisions concerning the future technological supremacy of the Air Force or envision and prevent technological surprise when they lack basic education and practical experience in science and technology. As Plato realized, "political leaders must know more than politics. The best and the brightest must be given an intense education in the arts and sciences in order to develop a cadre of future leaders-philosopher kings."

## Conclusions

> *We have moved from the age of the horse and the sail through the age of the battleship and the tank to the age of the airplane. Like its illustrious ancestors, the airplane will have its day in the sun, and then it too shall be replaced.*
>
> — Colonel John Warden, USAF, 1992

The role of TOs as envisioned by the post-WWII SAB report, *Toward New Horizons*, and the future role in the post-Cold war SAB report *New World Vistas* were examined. Today's role of USAF TOs according to the existing officer career path guide was also discussed. The context of the TOs 'roles and mission' examination revolved around advanced technical education and a viable path to senior leadership positions.

USAF technological superiority has continually been touted as a vital national security resource by SAB reports. The key to maintaining USAF technological superiority is the men and women of the technical officer corps. This paper proposes a number of innovative ideas to enhance the future role of USAF technical officers. These proposals are strongly rooted in the findings of SAB reports from General Arnold's day to the present. Concepts such as the formation of a technical officer corps (TOC), its vigorous management by the USAF personnel system to eliminate recruitment and retention shortfalls in the future Air Force, and development of a clear path to senior leadership positions within the USAF were put forth.

General Marsh declared the conventional requirement process "tends mainly to seek improved variations on existing systems." Without "zealous advocates" "frequently" operating "in the face of a 'show-me' attitude, or even a negative attitude on the part of the operational community and approval authorities," the Air Force risks becoming trapped in a process where needs "pull" technologies into use. This is unlike the former "push" processes, with the result being "we will become trapped in incrementalism and fail to achieve important outflanking capabilities."[11]

Outflanking maneuvers in the third dimension to defeat the enemies of America and the free world through Air Force technological superiority can be assured by the "high-tech" men and women of the technical officer corps. The students of Air Command and Staff College Class of 2000 have been admonished, advised, briefed, and cajoled to become advocates of aerospace power, but not zealots. Future technical officers as "zealous advocates" of USAF technological dominance now, and in the future, will provide answers to any question concerning the Aerospace Force's long-range strategic vision and maintain eternal vigilance for technological surprises and any other 'bolts from the blue' America and the free world may encounter.

**Notes**

[1] General John M. Shalikashvili, Chairman of the Joint Chiefs of Staff, *National Military Strategy of the United States of America, Shape, Respond, Prepare Now: A Military Strategy for a New Era* and *Joint Vision 2010,* 1997.

[2] Air Force Association Special Report, "Shortchanging the Future: Air Force Research and Development Demands Investment," Air Force Association Science and Technology Committee, January 2000, 17.

[3] Thomas A. Sturm, *The USAF Scientific Advisory Board: Its First Twenty Years,* The United States Air Force Special Studies (Washington, D.C., New Imprint by the Office of Air Force History, 1986), 44.

[4] Gannett News Service, "Air Force Faces Personnel Crisis," *Montgomery Advertiser,* 2 February 2000.

[5] Robert F. Dorr, "Washington Watch," *Aerospace America*, September 1999, 9.

[6] Richard A. Chilcoat, "The Revolution in Military Education," *Joint Force Quarterly,* No. 2, Summer 1999, 61.

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[7] Navy Personnel Command, *Perspective – The Career Issue,* Volume 2, January-February 2000, 13.

[8] Mark A. Lorell and Hugh P. Leveaux, *The Cutting Edge: A Half Century of U.S. Fighter Aircraft R&D,* Project Air Force, RAND (Santa Monica, CA, RAND Press, 1998), *xv.*

[9] Committee on Strategic Assessment of U.S. Aeronautics, "Recent Trends in U.S. Aeronautics Research and Technology," NASA NASW-4938 (Washington, D.C.: National Academy Press, 1999), 10.

[10] Colonel T.S. Kelso, AFIT Vice Commandant, private communication.

[11] Air Force Association Special Report, 20.

# Appendix

## USAF Technical Officer Air Force Specialty Codes

For the purposes of a working definition for this paper, the specific Air Force Specialty Code (AFSC) and educational requirements for the technical officer corps (TOC) scientists (AFSC **61SX**), engineers (AFSC **62EX**), and program managers (AFSC **63AX**) are as follows:

**61S4—Staff Scientist:**
Bachelor or Master's degree in science, mathematics, engineering, or physics

**61S3A—Scientist, Analytical:**
Bachelor's degree in science, mathematics, engineering, or physics

**61S3B—Scientist, Behavioral:**
Bachelor's degree in psychology, human engineering, or related social science with 24 semester hours in quantitative methods, measurement, experimental design, research methods, and human development

**61S3C—Scientist, Chemist:**
Bachelor's degree in chemistry, biology or chemical engineering

**61S3D—Scientist, Physicist:**
Bachelor's degree in nuclear engineering or physics

**62E4—Staff Developmental Engineer:**
Bachelor's or Master's degree in engineering

**62E3A—Developmental Engineer, Aeronautical:**
Bachelor's degree in aeronautical or aerospace engineering

**62E3B—Developmental Engineer, Astronautical:**
Bachelor's degree in aeronautical or aerospace engineering

**62E3C—Developmental Engineer, Computer:**
(1) Bachelor's degree in computer or electrical engineering with 12 semester hours in computer science, or
(2) Bachelor's degree in engineering with 12 semester hours in computer, electrical, or electronics engineering and 12 semester hours in computer science, or
(3) Bachelor's degree in computer science with 12 semester hours in engineering

**62E3E—Developmental Engineer, Electrical:**
Bachelor's degree in electrical engineering

**62E3F—Developmental Engineer, Flight Test:**
Completion of Air Force Flight Test Engineer Course or DoD of foreign equivalent school, plus bachelor's degree in engineering, physical science, or mathematics

**62E3G—Developmental Engineer, Project:**
Bachelor's degree in engineering

**62E3H—Developmental Engineer, Mechanical:**
Bachelor's degree in mechanical, aeronautical, aerospace, or astronautical engineering

The education, training, and experience requirements for the technical officer corps (TOC) (acquisition) program managers are as follows:

**Education**: For entry AFSC **63A1**, completion of an undergraduate degree in engineering, engineering science, engineering management, mathematics, analytical science, physical science, business or management is mandatory.

**Training**: For award of AFSC **63A3**, completion of Defense Acquisition University Fundamentals of Acquisition Management (ACQ 101) course or Acquisition Fundamentals Course (L30QR63A1) is mandatory.

**Experience**: For award of AFSC **63A3**, a minimum of 18 months acquisition experience is mandatory.

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